

Health Consultation

Public Comments on the Draft Management Plans
Remedial Investigation of the Marine Environment
Former Rayonier Pulp Mill (a/k/a Rayonier Mill)
Port Angeles, Clallam County, Washington

May 3, 2002

Prepared by

**The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**



Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of a health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond quickly to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health.

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Glossary

Acute	Occurring over a short period of time. An acute exposure is one which lasts for less than 2 weeks.
Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Cancer Risk Evaluation Guide (CREG)	The concentration of a chemical in air, soil or water that is expected to cause no more than one excess cancer in a million persons exposed over a lifetime. The CREG is a <i>comparison value</i> used to select contaminants of potential health concern and is based on the <i>cancer slope factor</i> (CSF).
Cancer Slope Factor	A number assigned to a cancer causing chemical that is used to estimate it's ability to cause cancer in humans.
Carcinogen	Any substance that can cause or contribute to the production of cancer.
Chronic	A long period of time. A chronic exposure is one which lasts for a year or longer.
Comparison value	A concentration of a chemical in soil, air or water that, if exceeded, requires further evaluation as a contaminant of potential health concern. The terms comparison value and screening level are often used synonymously.

Contaminant	Any chemical that exists in the environment or living organisms that is not normally found there.
Dose	A dose is the amount of a substance that gets into the body through ingestion, skin absorption or inhalation. It is calculated per kilogram of body weight per day.
Environmental Media Evaluation Guide (EMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The EMEG is a <i>comparison value</i> used to select contaminants of potential health concern and is based on ATSDR's <i>minimal risk level</i> (MRL).
Exposure	Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short-term (acute) or long-term (chronic).
Groundwater	Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes.
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Indeterminate public health hazard	Sites for which no conclusions about public health hazard can be made because data are lacking.
Ingestion rate	The amount of an environmental medium which could be ingested typically on a daily basis. Units for IR are usually liter/day for water, and mg/day for soil.

Inorganic	Compounds composed of mineral materials, including elemental salts and metals such as iron, aluminum, mercury, and zinc.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.
Minimal Risk Level (MRL)	An amount of chemical that gets into the body (i.e., dose) below which health effects are not expected. MRLs are derived by ATSDR for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.
Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
No public health hazard	Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.
Oral Reference Dose (RfD)	An amount of chemical ingested into the body (i.e., dose) below which health effects are not expected. RfDs are published by EPA.
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides which are not easily dissolved in water.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.

Remedial investigation

A study designed to collect the data necessary to determine the nature and extent of contamination at a site.

Route of exposure

The way in which a person may contact a chemical substance that includes ingestion, skin contact and breathing.

U.S. Environmental Protection Agency (EPA)

Established in 1970 to bring together parts of various government agencies involved with the control of pollution.

Volatile organic compound (VOC)

An organic (carbon-containing) compound that evaporates (volatilizes) easily at room temperature. A significant number of the VOCs are commonly used as solvents.

Background and Statement of Issues

The Washington Department of Health (DOH) has prepared this health consultation in response to a request from the Washington Department of Ecology (Ecology) to conduct a technical review of the Rayonier, Inc. (Rayonier), *Management Plans for the Remedial Investigation of the Marine Environment, Former Rayonier Pulp Mill, Port Angeles, Washington*.¹ The management plans, which include marine investigation plans (i.e., work plan, sampling and analysis plan, quality assurance project plan (QAPP)) and interim actions work plan, are part of a tri-party agreement negotiated by Ecology, the Lower Elwha Klallam Tribe, and Rayonier. This health consultation report, which contains comments on the management plans, is being submitted as part of the public comment period for the document.

The former Rayonier pulp mill is located at 700 North Ennis Street, on the northern edge of downtown Port Angeles. The mill property consists of approximately 80-acres including submerged land in the southeastern portion of Port Angeles Harbor, adjacent to the Strait of Juan de Fuca, along the northern coast of the Olympic Peninsula (Figure 1). The pulp mill operated between 1930 and 1997, using an acid sulfite and bleaching process to produce acetate, specialty paper, fluff, and viscose grade pulps from wood chips. Most of the facility has been dismantled since its closure.¹

The mill produced and discharged approximately 36 million gallons of effluent per day to the harbor and the Strait of Juan de Fuca.² Process effluent including spent sulfite liquor and storm water generated on the mill property was discharged directly into Port Angeles Harbor through five near shore outfalls from 1930 until 1972 (Figure 2).^{1,3} Each near shore outfall had a separate source with different flow and solids characteristics: Outfall A - hydraulic barker; Outfall B - screen room; Outfall C - blow pits plus part of bleach plant; Outfall D - bleach plant and machine room; and Outfall E - miscellaneous small flows. Effluent flow rates and total suspended solids levels for these outfalls were estimated by Rayonier and are presented in Figure 3.²

A primary treatment system was installed at the facility in 1972 to remove settleable solids and all the near shore outfalls were reportedly removed from service at that time.^{1,3} However, some information indicates that at least Outfall C remained in service in 1975 and that toxic quantities of waste were periodically released.⁴ The new treatment system routed all effluent and storm water to a deep water outfall that extends approximately 7,900 feet into the Strait of Juan de Fuca with the last 940 feet acting as a diffuser. A secondary treatment system was constructed at the site in 1979 to reduce the organic contaminant levels.^{1,3}

Average total suspended solids (TSS) discharged through the near shore outfalls were approximately 172 milligrams per liter (mg/l). This is equivalent to approximately 55,000 pounds per day (lbs/day) of TSS assuming a 36 million gallon per day effluent discharge. These concentrations decreased to about 48 mg/l or 15,000 lbs/day following installation of the primary treatment system in 1972 but increased again to 128 mg/l or 41,000 lbs/day when the secondary treatment system was installed in 1979. Rayonier attributes the increase in 1979 to discharge of

organisms associated with secondary treatment. Limited effluent data suggests that chemicals such as dioxins and furans; chlorinated phenols; volatile organic compounds such as acetone, chloroform, and 2-butanone; and metals were components of the effluent and that effluent temperature ranged from approximately 17 to 32°C (63-90°F).²

Although process effluent and storm water are significant sources of potential marine contamination, other contaminant sources existed at the facility including contaminated fill, accidental spills and leaks, and stack emissions. A number of environmental investigations have been conducted at the mill site. Dioxins, furans, petroleum constituents (e.g., polynuclear aromatic hydrocarbons (PAHs), benzene, ethylbenzene, toluene, and xylene), polychlorinated biphenyls (PCBs), solvents, and metals were some of the detected chemicals of concern.³

Ecology provided the management plans for the marine investigation and the interim action work plan to DOH and other agencies (Regulatory Technical Advisory Group (RTAG)) for preliminary review in early February 2002 to identify any issues that might delay release of the plans to the public.⁵ During that brief review period, DOH identified some significant issues and concerns.⁶ However, Ecology determined that none of the issues raised during this preliminary review should delay the public release.⁷ The following discussion summarizes issues and concerns identified during DOH's detailed review of the management plans that, as requested, are being submitted as part of the public comment period.⁵

Discussion

The management plans for the marine investigation describes work that will be done to characterize marine contamination in the adjacent Port Angeles Harbor and Strait of Juan de Fuca while the interim actions work plan outlines possible cleanup options for some of the upland areas

DOH identified significant issues and concerns regarding the management plans for the marine investigation. Some issues and concerns about the proposed upland interim action work plan were also identified. The following items summarize DOH's comments and recommendations on the documents:

Work Plan

1. **Section 2.0 Site Background and Setting:** There is no information provided about the hazardous substances used and/or generated at the mill site and what chemicals were likely discharged into the marine environment throughout the operation of the mill. This basic background information is critical for evaluating whether the proposed analyte lists presented later in the work plan, and in the sampling and analysis plan, are adequate.

Recommendation: Information should be added to the work plan that describes hazardous

substances used, generated, and released at various process points during the mill's operation. This would include, but is not limited to, chemicals like dioxins and furans from the bleach plant, the No. 9 washer, and air emission sources; volatile organic compounds (e.g., acetone, chloroform, 2-butanone) detected in the wastewater effluent and sludge; chlorinated phenols from the bleach plant and No. 9 washer; and metals associated with the spent sulfite liquor.⁴ Hazardous substances associated with leachate from the Mount Pleasant landfill that are disposed at the mill's secondary treatment plant should also be included.⁴

2. **Section 2.1, Description and History of Operation:** Historic mill process information (1930 to 1997) is critical background information. The work plan text and accompanying Figure 2-3 provide information about processes occurring at the mill at the time it closed in 1997. Although this is good information, it does not represent historic mill processes, particularly prior to 1972 when significant quantities of untreated mill effluent was released directly into the marine environment from the five near shore outfalls.

Recommendation: A diagram showing process flows prior to the installation of the primary treatment system in 1972 should be added to the work plan because installation of this treatment system affected effluent contaminant levels and discharge patterns. Other significant process changes that could have affected hazardous substance use, generation, and releases should be described in the work plan.

3. **Section 2.1 Description and History of Operations:** The work plan indicates that chlorine dioxide and sodium hypochlorite were produced on site. However, no information is provided about these processes so it is unknown whether they are a potential source of site contamination.

Recommendation: The chlorine dioxide and sodium hypochlorite processes should be described in the work plan. Any potential contaminants associated with these processes should be described.

4. **Section 2.1 Description and History of Operations:** Maintenance dredging was done at the chip barge berth in 1991, 1992, 1994, 1995, and 1996. The "log pond pocket adjacent to the Bundle Deck" was also dredged.⁴ However, none of these dredged areas are shown on a site map although this is important site information when evaluating proposed sediment sample locations and depths.

Recommendation: The dredged areas described above and any other dredged areas should be described and shown on a site map that is incorporated into the work plan. The depth of dredging should be provided on the map.

5. **Section 2.1 Description and History of Operations:** Acetate, speciality paper, fluff, and viscose grade pulps were produced at the mill.¹ However, there is no discussion that

indicates whether significant differences in the process or effluents associated with the production of these various grades of pulp existed.

Recommendation: A description about the processes used to produce acetate, speciality papers, fluff, and viscose grade pulps including chemical use, generation, and release, should be added to the work plan.

6. **Section 2.2.4 Soils and Groundwater:** Historic chemical spills and leaks and contaminated fill materials (wood waste, ash, and demolition debris) are primary sources of contamination that can affect groundwater quality at the mill site. Site groundwater discharges to Ennis Creek and the adjacent marine waters.³ However, there is no information provided in the work plan that describes how these groundwater releases may have affected nearby sediment, surface water, or biota that live and feed in this environment.

Recommendation: The groundwater to surface water and sediment pathways should be evaluated and described in the work plan.

7. **Section 2.2.6.1 Marine Environment:** A number of key pieces of information are missing from this section of the work plan: (a) studies and other information about movement of marine currents including studies conducted by Rayonier when siting its deep water outfall⁹; (b) historic dive survey results (c) rates and locations of sediment deposition and erosion within the Port Angeles Harbor and adjacent Strait of Juan de Fuca; (d) characteristics, movement, and deposition patterns of the effluent released by Rayonier from the near shore and deep water outfalls; and (e) effluent chemical changes (e.g., precipitation) that may have occurred when Rayonier's freshwater effluent was discharged to the marine environment and its influence on deposition patterns. This information is critical background information for determining which sediment areas should be sampled; the depth of the samples; and assist in the selection of biota sampling locations.

Recommendation: All of the above information about the marine environment should be evaluated and summarized in the work plan and data gaps identified.

8. **Section 2.2.6.1 Marine Environment:** The Rayonier mill discharged significant volumes of effluent (treated and untreated) to Port Angeles Harbor and the Strait of Juan de Fuca that contained contaminants such as dioxins and furans, VOCs, and chlorinated phenols that likely affected the health of the fish and shellfish communities and may account for the small number of individuals available for biota testing.^{1,4} A number of studies including one by Shea, et al. (1981), which evaluated the history, dispersion, and effects

of pulp mill effluents on marine water near Port Angeles, were mentioned in the work plan but the findings were not summarized.¹

Recommendation: The findings from the various studies about effects of the mill on fish and shellfish communities including bioassay results obtained by Rayonier as part of its National Pollutant Discharge Elimination System (NPDES) permit should be provided in the work plan.

9. **Section 2.2.6.1 Marine Environment, Shellfish:** The work plan identifies commercial and non-commercial shellfish species found in the Port Angeles area. However, the plan does not indicate where specific shellfish are located relative to the Rayonier Mill site, where they are being harvested, an estimate of the mass of different shellfish harvested each year, or provide information about who is consuming the various shellfish species or their dietary or culinary preferences (e.g., whole body, organs, size). There is also no information about potential future shellfish harvesting. This information is important for evaluating whether the biota selected for tissue sampling are appropriate.

Recommendation: The information cited above should be added to the work plan.

10. **Section 2.2.6.1 Marine Environment, Fish:** Although the most commonly consumed species of fish found with the Port Angeles Harbor or near the Rayonier Mill have been identified along with the general human receptors, there is no information provided in the work plan to indicate where they are being caught, the mass of each species harvested each year or anticipated to be harvested in the future. In addition, no specific information about what species each receptor group is ingesting and their dietary or culinary preferences (e.g., whole body, organs, size) is provided. As with shellfish, this information is important for evaluating whether the biota selected for tissue sampling represent commonly consumed species.

Recommendation: The information cited above should be provided in the work plan to support the proposed sampling plan.

11. **Section 3.0 Initial Evaluation:** Many of the figures in this section of the report do not have scales although maps and aerial photos are used as a base map. This makes it difficult to evaluate the data presented on the figures.

Recommendation: A scale should be included on all maps.

12. **Section 3.1 Summary of Previous Investigations:** The work plan states, “prior studies have been identified and reviewed to identify contaminants associated with the site, and their potential routes of exposure. The investigations reviewed within this section are not meant to be a compilation of all information related to the Rayonier Mill Site.”

Recommendation: All of the historic work done at the site to characterize marine contamination and contaminant discharges and identify routes of exposure should be summarized in the work plan along with a discussion about data quality. Data gaps should be clearly identified.

13. **Section 3.1 Summary of Previous Investigations:** According to the work plan, the data collected by the Environmental Protection Agency (EPA) during its expanded site investigation (ESI) in 1997 and 1998 serve as the basis for much of the marine investigation. The ESI goals were to determine whether the site was eligible for placement on the National Priorities List and, if so, support EPA's case for listing the site; and alert EPA to immediate threats to public health or the environment and evaluate whether early action/removal activities were appropriate for the site. These goals differ from the goals of the Rayonier marine investigation, which is to determine the nature and extent of contamination so current and future risks to human health and the environment can be assessed.^{1,3}

Although the ESI data certainly is useful for beginning to understand the nature and extent of the impacts of the pulp mill on the marine environment and can be built upon, it does not represent a baseline evaluation of the potential impacts of the Rayonier facility on the nearby marine environment. For example, sediment samples were collected from suspected target areas during the ESI. However, it does not appear that hydrographic information such as the Rayonier outfall study conducted in 1971 for the marine environment was considered when selecting these target sample locations.^{3,9} As a result, the areas identified during the ESI as potentially contaminated may not represent areas where the highest concentrations of contaminants were deposited.

There is also no discussion about the ESI data quality. Based on preliminary scan of EPA's data, some potential problems appear to exist with the data set. For example, the sediment samples were homogenized, which can result in the loss of volatile organic compounds.³ These types of sampling problems can result in contaminated areas being screened out from further evaluation although contaminated sediments and biota may exist.

Recommendation: The limitations of the ESI study should be included in the work plan. ESI data should be critically evaluated to determine if it can be used as the basis for subsequent investigations. The results of this evaluation should be summarized in the work plan.

14. **Section 3.1 Summary of the EPA Expanded Site Investigation:** The analytical results for the ESI sediment samples (Figure 3-2) are only presented as ranges of values and some of them are organic carbon normalized. Although this is a good summary for an ecological assessment, it is not a useful presentation of data when trying to determine

what portions of the marine environment have been tested and identifying where elevated levels of chemicals are located.

Recommendation: The ESI marine sediment sample results should be presented in a table in the work plan.³ Reporting limits and qualifiers should be included for nondetected results. Figures showing the distribution of the significant chemicals of concern (e.g.,

dioxin and furans) should also be provided.

15. **Section 3.1 Summary of the EPA Expanded Site Investigation:** Washington Sediment Quality Standards (SQS) were compared to sediment data results to determine whether an area was a potential ecological risk. However, SQS do not exist for dioxins and furans and other significant contaminants of concern. As a result some areas with elevated levels of contaminants were screened from further evaluation. This is inconsistent with the Washington Sediment Management Standards (SMS), Chapter 173-204 WAC.¹⁰

Recommendation: The lack of SQSs and CSLs for dioxins, furans, and other chemicals should be noted in the text and figure 3-4. The potential impact of all the sediment contaminants should be evaluated as required in the Washington SMS.

16. **Section 3.1.1, Marine Sediments:** The work plan cites a low potential for organic chemical contamination of sediment adjacent to the deep water outfall diffuser based on a study of sediment quality conducted near the diffuser in May and June 1993. Neither the basis for this conclusion, nor the location(s) where organic chemicals were likely deposited, is discussed.

Recommendation: The work plan should be expanded to include the rationale for the conclusion about organic chemical deposition near the diffuser. A discussion about where chemical deposition associated with the diffuser likely occurred should be added to the plan.

17. **Section 3.1.1.1 Summary of the EPA Expanded Site Investigation, page 3-6, last paragraph:** The work plan indicates that fluoranthene was the only chemical of concern at sediment station SD36. Figure 3-4, which summarizes the chemicals of concern, indicates that in addition to fluoranthene, benzo(a) anthracene, pyrene, and chrysene were also identified as chemicals of concern.

Recommendation: The work plan should be revised to provide consistent information about sediment station SD36.

18. **Section 3.1.1.2, Subsequent Log Pond Sampling:** The TOC values in the log pond area ranged from 7 to 27%. This can result in organic carbon normalized data that is inappropriately low.¹¹

Recommendation: Consistent with Ecology guidance, it should be noted in the work plan that “if TOC concentrations in sediments have been increased above normal concentrations by organic contamination (such as wood chips, sewage, or petroleum), the OC-normalized values may be inappropriately low. In these cases, although the OC-normalized chemical criteria would not be exceeded, the sediments may still cause adverse biological effects and may therefore exceed the narrative standards or biological criteria. To address this concern, if the organic chemicals or substances that are the

primary contributors to the elevated TOC levels are known, the contribution of the organic contaminants to the percent TOC may be determined through analytical methods and subtracted from the TOC value before OC normalizing. Alternatively, as described above, biological testing or dry weight AETs may be used to evaluate sediment toxicity.”¹¹

19. **Section 3.1.1.2, Subsequent Log Pond Sampling, Table 3-4:** 2,4 dimethylphenol and 2 methylphenol, two chemicals of concern for this site, were not detected at reporting limits of 100-200 parts per billion (ppb) dry weight (dw) and 70-90 ppb dw, respectively. However, these reporting limits were not compared to the SQS as they were for other chemicals although they do exceed the standards (29 ppb dw for 2,4 dimethylphenol and 63 ppb dw for 2 methylphenol).

Recommendation: The table should be revised and discussion should be added about the elevated reporting limit and potential for 2,4 dimethylphenol and 2 methylphenol as site contaminants.

20. **Section 3.3.1 Primary Contaminant Sources:** Four sources were identified at the Rayonier Mill site as the primary contaminant contributors: ash from the boilers; leaks and spills of fuel oil and associated chemicals; leaks and spills from workshops and process areas; and bark and wood debris. Although potentially significant sources in terms of toxicity; they are relatively insignificant in terms of volume when compared to the effluents that were discharged to marine waters from 1930 to 1997.

Recommendation: Process effluents should be added to the work plan as a primary contaminant source. Dioxins/furans and other chemicals should be listed as the chemicals of concern associated with this source.

21. **Section 3.3.3, Primary Transport Mechanisms:** Water is a primary transport mechanism for mill effluents discharged to the marine environment. However, it is not listed or discussed in this section of the work plan.

Recommendation: Water transport of mill effluents should be added to the work plan.

22. **Section 3.3.5, Potential Pathway and Exposure Routes:** The work plan indicates that “for an exposure pathway to be complete, it must have three components: (1) a source of chemical, (2) an exposure point concentration where contact can occur, and (3) an exposure route by which contact can occur.” However, this is inaccurate. A completed exposure pathway consists of five elements: source, transport mechanism, point of exposure, route of exposure, and receptors. A potential exposure pathway occurs when at least one of these five components is missing. In addition, ingestion of contaminated biota, one of the pathways of significant concern for this site, has not been adequately discussed.

Recommendation: The general discussion about the elements of completed and potential exposure pathways should be revised. Ingestion of contaminated biota should be addressed in the work plan.

23. **Section 3.3.5, Potential Pathway and Exposure Routes:** The exposure pathway discussion is not well organized and does not clearly indicate completed and/or potential exposure pathways for the site.

Recommendation: This section of the work plan should be reorganized and rewritten. Completed and potential exposure pathways should be clearly described. A table provides a good method of summarizing this type of information. Specific receptors (e.g., tribal subsistence, recreational anglers) should be clearly identified as current and/or future receptors.

24. **Section 3.3.5.1, Exposure Pathways of Concern, Historical Air Discharges:** The work plan acknowledges that historical particulate emissions from the Rayonier Mill site could affect off-site soils. However, it states that “because the off-site area is predominantly urban, exposure to environmental receptors is of secondary concern.” If environmental receptors means humans, DOH does not concur with this conclusion. People’s exposure to particulates released from the Rayonier facility, which may have contained dioxins and furans and were deposited in nearby neighborhoods, is a potential additional exposure to chemicals above that typically found in urban neighborhoods where such releases have not occurred. As a result, these potential exposures are a primary concern to DOH.

Recommendation: The work plan should be revised to clarify what is meant by “environmental receptors.” If environmental receptors means human, the work plan should be revised to indicate that this exposure pathway is of primary concern and that it will be evaluated as part of the upland remedial investigation. The evaluation would include appropriate modeling to determine where particulates released from the former mill would have been deposited in the nearby community along with off-site sampling to confirm model results and evaluate exposures.

25. **Section 3.3.5.1, Exposure Pathways of Concern, Marine Discharges:** Direct contact with sediments (dermal and incidental ingestion) during fishing, shellfish harvesting, diving, and other potential activities under current and future exposures is anticipated to be minimal. However, it is still an exposure pathway that needs to be evaluated during the RI.

Recommendation: The direct contact with sediments pathway should be addressed in the work plan and evaluated quantitatively as part of the investigation. EPA has recently released draft risk assessment guidance (RAGS Part E) that should be consulted for evaluating dermal exposure.

26. **Section 4.2.1, Marine Sediments:** Contaminated groundwater and past, direct effluent

discharges through near shore outfalls and contaminated surface water runoff may have affected intertidal sediments and sediments located east of the mouth of Ennis Creek. However, no sediment sampling is proposed in these areas although they may have been affected by these discharges.

Recommendation: The work plan should be expanded to include intertidal sediments and sediments east of the mouth of Ennis Creek where dermal contact and incidental ingestion of sediments and ingestion of biota is possible, particularly in the future.

27. **Section 4.2.1, Marine Sediments:** The work plan indicates that “the general approach to the marine sediment portion of the RI is to assess the sediment quality in terms of the Washington State SMSs.” Although this approach is appropriate for an ecological assessment, it is not appropriate for evaluating dermal contact and incidental ingestion in human receptors.

Recommendation: The work plan should be revised to address this issue.

28. **Section 4.2.1, Marine Sediments:** DOH cannot determine whether the three areas proposed for sediment sampling (deep water outfall, dock, and log pond) are the only areas of concern at the site. These areas were selected based on exceedance of SQS. The work plan states that “if an EPA ESI station does not exceed any SQS values, no further sediment evaluation is necessary.” This may be an appropriate strategy if all potential contaminants have been analyzed and SQS values exist for each chemical detected. However, this is not the case for this project where no SQS values exist for some of the detected chemicals (dioxins, furans, VOCs, or some of the metals). Ignoring chemicals that lack an SQS is inconsistent with the Washington sediment regulations (WAC 173-204-310(3)).

The rationale for excluding dioxin and furan analysis for any of the proposed sampling areas is unclear. Only a third of the marine sediment samples analyzed for dioxins during the ESI using the P450 screening method were confirmed by an analytical laboratory (EPA Method 8290). DOH evaluated the correlation between these two data sets and obtained a correlation coefficient of 0.2, which indicates that there is little linear relationship between the two analytical methods. As a result, the P450 results are questionable. The EPA analytical method results indicate that TEQs and TCDD levels exceed background values obtained from the nearby Dungeness Bay, except at a couple of locations that may represent erosional areas. This suggests that dioxin and furans are chemicals of concern and should not be eliminated from future sampling.

Recommendation: The sediment locations where SQS values were not exceeded but contain elevated levels of chemicals with no SQS should be further evaluated to determine whether they pose a threat to human and ecological receptors. Sediment and biota testing at these locations should be considered appropriate evaluation tools. Dioxin and furans should be analyzed during the marine investigation.

29. **Section 4.2.1, Marine Sediments:** It appears that decisions about subsequent phases of the sediment investigation will be based on the surface sediment sampling results (chemistry followed by toxicity testing if SQS exceeded). The rationale for this approach is unclear particularly since this facility discharged effluents containing dioxin and other contaminants for 67 years and deeper sediments that clams and geoduck inhabit are likely more contaminated than surface sediments.

Recommendation: The work plan should include a discussion about changes in sediment quality over the operation life of the mill. For example, effluent was discharged from the near shore outfalls for almost 42 years, followed by a 25 year period where no effluent discharged. Given the right environment, this could result in clean sediments overlying contaminated sediments. This type of information should be used to select appropriate sampling depths.

30. **Section 4.2.1.1, Area Around the Deep Water Outfall:** The work plan indicates that “preliminary effluent depositional modeling” was used to determine the zone of the highest solids deposition from the Rayonier deepwater outfall. DOH understands that this model has not been approved by Ecology or the Lower Elwha Klallam Tribe. However, sediment sample locations were selected based on the modeling results.

Recommendation: The effluent depositional model results should undergo agency review before sediment sampling locations around the deepwater outfall or any other area are deemed appropriate. Staff or contractors with significant modeling experience should be used to evaluate the model. A technical memorandum summarizing the results of the review should be provided to the RTAG.

31. **Section 4.2.1.1, Area Around the Deep Water Outfall:** Eight sampling locations are proposed around the outfall. PCBs will be analyzed in all surface sediment samples. PAHs are proposed for three of the eight surface sediment locations. However, no rationale for this decision is provided.

Recommendation: The rationale for limiting PAH analysis to the three locations should be provided in the work plan.

32. **Section 4.2.1.1, Area Around the Deep Water Outfall:** The work plan indicates that “dioxin and furan values in samples EPA collected near the outfall were very low or non detect with TEQ values less than 1 part per trillion (ppt). Consequently, additional dioxin/furan testing is not necessary in the areas already sampled.”

The work plan neglects to say, however, that only two of the fourteen sediment samples analyzed by EPA for dioxins/furans were confirmed analytical results (SD 59 and SD62 where TEQs and TCDDs exceeded background values collected from Dungeness Bay). SD62 lies outside the area predicted by the depositional model to be affected by Rayonier

effluent leaving only the results from SD59, near the southern limit of the potentially affected area, to determine whether dioxins/furans are a problem near the deep water outfall. The report also does not provide the rationale for using 1 ppt TEQ as a screening value.

Recommendation: Dioxin/furans are potential contaminants associated with the effluent discharges from the mill. The dioxin/furan testing should be expanded to include areas where EPA sampled in the past but did not obtain laboratory confirmed results to ensure these are not areas of concern. The rationale for using 1 ppt TEQ as a screening value should be provided.

33. **Section 4.2.1.2, Area Around the Rayonier Dock:** Nine of the ten sediment samples analyzed by EPA at the dock area for dioxins/furans during the ESI had TEQs values (0.42-6.06 ng/mg) and eight of the ten samples had TCDD values (0.19-230 ng/kg) above the background samples collected in Dungeness Bay. Seven of the eastern most samples had only P450 analysis which did not correlate well with the analytical lab results.³ However, the work plan indicates that no additional dioxin/furan samples will be collected. Additional data is necessary to determine the lateral and vertical extent of contamination at the dock and in the eastern portion of the dock area.

Recommendation: The lateral and vertical extent of dioxin/furan contamination should be evaluated by conducting additional dioxin/furan analysis.

34. **Section 4.2.1.3, Long Pond Area:** The log pond area, where TOC ranges from 1 to 27%, contains elevated TEQs, up to 6.06 nanogram/kilogram (ng/kg). Additional dioxin/furan sampling is proposed. However, it is limited to resampling surface samples.

Recommendation: The lateral and vertical extent of the dioxin/furan contamination should be evaluated in the sediment investigation.

35. **Section 4.2.1.3, Log Pond Area:** Bioassay are planned for any sample with chemicals of potential concern above the SQS. Since no SQS exist for dioxin/furan, samples with elevated dioxin/furan results could be screened from the bioassay testing although it is a significant contaminant of concern.

Recommendation: Some log pond samples with the highest TEQs should be evaluated using bioassays.

36. **Section 4.2.2 Marine Biota:** Biota tissue sampling is proposed in support of an ecological and human health risk assessment. Three sampling areas where EPA identified contaminated sediments in 1997 and 1998 are proposed to be sampled: log pond, dock facilities, and deepwater outfall. However, there is no information provided in the work plan to indicate whether past, present, or future collection of shellfish or fishing by

subsistence, commercial, or recreational receptors will occur at these or other contaminated locations affected by the mill. As a result, it is impossible for DOH to determine whether these are appropriate locations or species for evaluating human health risks.

Recommendation: Biota sample collection locations should be determined based on sediment chemical concentration data as a surrogate indicator of historic water quality conditions, hydrographic conditions, and anticipated biota harvest locations. Site selection should not be based on the arbitrary assumption of where concentrations may be elevated in the sediment, such as at the deepwater diffuser, which was intentionally located so as to diffuse effluent over a broad area.

37. **Section 5.4.1.2, Marine Sediments:** Risk assessment parameters proposed for the seafood consumption pathway are not provided in the work plan. The work plan does not indicate how MTCA risk-based bench marks and bio-sediment accumulation factors (BSAFs) will be established and used..

Recommendations: The information cited should be provided in the work plan.

Sampling and Analysis Plan

1. **General:** DOH cannot evaluate whether the general areas proposed for sampling (i.e., dock, log pond, deepwater outfall), specific locations within those areas (i.e., primary and secondary areas), sample depths, proposed chemical analysis, or selected biota are appropriate for the marine investigation because of an inadequate presentation of background information. As a result, DOH's comments on the sampling and analysis plan (SAP) are limited.

Recommendation: The work plan should be revised to address DOH's recommendations. The SAP should also be revised, as appropriate. Both documents should be resubmitted to DOH for review so it can determine whether the proposed data will be adequate for determining risks to human health.

2. **Section 2.1, Overall Design:** Sediment samples collected during the first phase of the marine investigation are proposed to be collected from the upper 10 centimeters (cm) of the sediment column. Deeper sediments will also be collected at the log pond and dock but only limited conventional parameters (e.g., TOC, grain size) are proposed to be analyzed. The deeper samples are proposed to be visually inspected for mill related contaminants and may be analyzed for site related contaminants if surface sediments exceed sediment criteria.

According to the SAP, "samples from the 10-cm mixed layer typically represent a time-

integrated chemical concentration for about the last 29 years.” Assuming this is true for the Rayonier site, the upper 10-cm represents deposition from approximately mid-1960s to the present, which likely represent 10 years of untreated effluent discharge overlain by 20 years of cleaner sediments in the area of the former near shore outfalls. Since Rayonier began operating at the site in 1930, it appears that the approximately upper 25-cm of sediment would be affected by the mill. Based on this information, it is inappropriate to limit sediment sampling and analysis during the first phase of the RI to the upper 10-cms particularly since burrowing organisms like clams, one of the two main burrowing organisms of concern at the site [the other geoduck] are expected to be found below the top 10-cm of sediment.¹

Recommendation: Those areas that are current and/or potential future sites of biota harvesting by subsistence, recreational, and commercial fisherman should be identified and sampled at appropriate depths. For example, if the log pond area is a current and/or potential future site of crab and clam harvesting then both surface and subsurface sediments should be analyzed. Appropriate chemical analyses including dioxin/furan should also be conducted to determine contaminant concentrations.

3. **Section 2.2 Chemical Analytes:** The subsections within this section of the SAP indicate that volatile organic compounds (VOCs) and/or metals in all samples were either not detected or below SQS. As noted earlier, sample homogenization may have affected VOC results for sediment. In addition, no SQS were available for the detected VOCs, dioxin/furan, and some of the metals results.

Recommendation: The SAP text should be revised to accurately report previous investigation and evaluation results.

4. **Section 2.4.4, Harbor Samples:** The Harbor sample locations are proposed for evaluating area background. However, based on the Rayonier preliminary depositional model results, the proposed sample locations appear to be in an area that may have been affected by releases from the near shore outfalls at the mill.

Recommendation: Tasks should be included in the work plan to determine whether the proposed harbor sample locations lie in area historically affected by Rayonier’s discharges.

5. **Section 3.2 Target Species for Sampling:** There is no justification for the number of biota samples (3) to be collected at each site. However, it seems very low given the goals of the project.

Recommendations: Sample size calculations should be performed based on past data or assumed variance data for the various chemicals and species in question and the results presented in the SAP. If this is to be a screening study of contaminants in biota, then details should be included for conducting a comprehensive study pending the results of

the proposed sampling.

6. **Section 3.2.2, Clams:** A mixture of butter, native littleneck, and manila clams are proposed as the target species unless an adequate mass of butter clams are available. While these clam species, as mentioned in the sampling plan, may have a "similar potential" to accumulate contaminants, these species vary metabolically and tend to occur in different substrates as well as at different depths, and therefore are likely to have differing levels of contamination. For example, butter clams tend to grow in deeper and perhaps muddier substrates than manila clams. DOH is unclear how the results from such a sampling strategy will be used to evaluate human exposures.

Geoduck, a long lived species likely to be harvested in the future, is not proposed to be collected and analyzed during the marine RI. DOH considers this to be a significant data gap that needs to be filled.

Recommendation: Composite clam samples should be comprised of single species as per EPA guidance. A discussion about how the results from a mixture of clam species would be used to assess risk to human health should be described in the management plans. Geoduck should be added to the shellfish sampling program and analyzed for all the same chemicals as other shellfish species.

7. **Section 3.3, Sampling Station Locations:** A one-day reconnaissance is proposed to be conducted just prior to collecting biota samples to determine species availability, abundance, and distribution. It is not clear that only one day will provide adequate time for completing this task, which should have been done in advance of the development of the sampling and analysis plan.

Recommendation: The reconnaissance period should be based on collecting the necessary biota information, not time limited.

8. **Section 4, Field Sampling Methods; Section 5, Sample Handling Procedures; and Section 6, Laboratory Analytical Methods:** The SAP indicates that Puget Sound Estuary Program (PSEP) protocols will generally be used for biota sampling. However, it is not clear that this guidance is adequate for collecting samples where human health risks are being evaluated.

Recommendation: Since the biota sampling will also be used to assess human health risks, EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories should be consulted to verify that samples are being collected and analyzed appropriately. This verification should be summarized in the SAP.

9. **Section 4.8.1, Site Logbooks:** Visual descriptions of sediment and biota samples are necessary for evaluating site data. However, it is not clear that this information will be

included in the logbook.

Recommendation: A visual description of each sediment sample (e.g., grain size, organic content, evidence of contamination) and biota sample (e.g., size, weight, physical descriptions) should be recorded in the logbook or sampling form.

10. **Section 7, Quality Assurance and Quality Control Requirements:** Table 5-1 and Section 9.8 from the QAPP are referenced in this section of the document. However, they do not exist.

Recommendation: The SAP should be revised as appropriate.

11. **Section 7.1, Data Quality Objectives:** There is not enough information provided in the management plans to determine whether the MDL or estimated quantitation limits are sufficiently low for measuring chemical concentrations in biota and sediments at levels that may be of human health concern.

Recommendation: Conservative health based screening values should be provided for the most sensitive human populations (e.g., subsistence level consumption rates) and compared to MDLs and estimated quantitation limits to ensure that the analytical methods will provide useful results.

12. **Section 9.1.1, Sediment Chemistry Data:** Direct contact (dermal and incidental ingestion) with sediments is a potential exposure pathway. No rules for generating the sums of chemical groups (e.g., dioxin/furans, PAHs) that will be used to evaluate the risks posed by direct contact with sediments are included in the SAP.

Recommendation: Appropriate rules should be added to the SAP.

Interim Action Work Plan

1. **Section 1.4 Regulatory Framework:** The State Environmental Policy Act (SEPA) requires all governmental agencies to consider a project's environmental impacts before making decisions about the significance of the project. Environmental impacts include environmental health hazards associated with toxic chemicals or hazardous wastes.¹² SEPA, however, is not included in the list of applicable or relevant and appropriate requirements (ARARs) listed in the work plan.

Recommendations: SEPA should be added to ARARs list.

2. **Section 2.1, Ennis Creek – Finishing Room Area:** Diesel and oil range petroleum hydrocarbons and polychlorinated biphenyls (PCBs) were discovered leaking from the former finishing room in 1989. Soils with greater than 1000 mg/kg total petroleum

hydrocarbons and 1 to 10 mg/kg PCB were reportedly excavated. There is no information provided in the work plan that indicates where the soils with residual levels of petroleum and PCB contamination are located or whether other petroleum chemicals including carcinogenic compounds (benzene, PAHs) and non-carcinogenic compounds (toluene, xylene, ethylbenzene, PAHs) are associated with the remaining soils. As a result, DOH could not determine the current or potential future health risks associated with direct contact of the remaining contaminated soils.

Recommendation: More information needs to be provided for DOH to determine if the residual contamination poses a current or future health threat including locations of residual soils. Areas with residual levels of contamination should be sampled and analyzed for carcinogenic and non-carcinogenic compounds not previously tested.

3. **Section 2.1, Ennis Creek – Finishing Room Area:** The work plan indicates that confirmation samples collected after the excavation of the finishing room area in 1998 were analyzed by an on-site mobile laboratory to confirm that cleanup levels were achieved. On-site mobile laboratories often provide screening level analyses to support field decisions such as conducting additional excavation work. Once screening levels indicate that residual levels of contaminated soil are below cleanup levels, final samples typically are collected and submitted to a fixed, analytical laboratory where more accurate results can be obtained.

Recommendation: The work plan should be expanded to include a discussion about the level of analytical accuracy associated with the on-site mobile laboratory.

4. **Section 2.1, Ennis Creek – Finishing Room Area:** Table 2-1 summarizes the analytical results obtained by the on-site mobile laboratory. The sample identification number for a number of samples suggests that these may be composite samples (e.g., Comp 2-4). Although composite samples are useful for determining whether a soil interval exceeds cleanup levels when conducting excavation work, they are not appropriate for determining residual levels of chemicals in soils.

Recommendation: A key should be provided so the sample identification number can be interpreted. If composites samples were used for confirmation samples, the limitations and data gaps associated with this approach should be discussed.

5. **Section 2.1.2, Contaminants of Concern:** In addition to diesel and oil range petroleum and PCBs, polynuclear aromatic hydrocarbons (PAHs) and the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), should also be considered chemicals of concern for the Ennis Creek finishing room area since they are common petroleum constituents. This approach is consistent with the MTCA cleanup regulation.¹³

Recommendation: The work plan should be revised to include the PAHs and BTEX

compounds.

6. **Section 2.2 Fuel Oil Tank No. 2:** PAHs were reported in Table 2-2 as nondetected chemicals. However, the detection limits, which can often be higher than cleanup levels, were not reported.

Recommendation: The detection limits for the individual PAHs should be summarized in the Table 2-2 footnotes.

7. **Section 2.2 Fuel Oil Tank No. 2:** Table 2-2, Footnote 1 indicates that the laboratory analytical results for petroleum hydrocarbons using EPA Method 8015 were not included in the table. However, these analytical results can represent different hydrocarbon ranges than those included in the table obtained using EPA Method 418.1.

Recommendation: The EPA Method 8015 and Method 418.1 analytical results should be included in Table 2-2 and summarized in the text.

8. **Section 3, Cleanup Levels:** Although PAHs and BETX compounds are associated with the types of petroleum products released at the proposed interim action areas, limited or no PAH or BETX analyses were conducted on samples collected from these areas in the past. As a result, these organic compounds remain potential contaminants of health concern and should be included in Tables 3-1 and 3-2.

Recommendation: PAHs and BETX compounds should be included as primary contaminants of concern for the interim actions.

9. **Section 3, Cleanup Levels:** The proposed MTCA Method B cleanup level selected for chromium (III) is 120,000 mg/kg. However, chromium is an inhalation carcinogen above soil concentrations of 230 mg/kg.

Recommendation: The soil cleanup level should be lowered to 230 mg/kg.

10. **Section 3, Cleanup Levels:** Volatile organic compounds (VOCs) are potential contaminants of concern at the former fuel tank no. 2 and the machine shop. DOH assumes that the soil to indoor air pathway was not considered when selecting VOCs cleanup levels because little VOC contamination is anticipated. This seems like a reasonable approach when small amounts of VOC contaminated soils exist. However, if significant amounts of VOC contaminated soils are discovered, the VOC cleanup levels may need to be lowered to prevent the migration of contaminants into structures that may be located at the site in the future.

Recommendation: The interim action work plan should be revised to include a statement about cleanup levels and the soil to indoor air pathway.

11. **Section 4, Interim Actions:** Cleanup actions under the MTCA cleanup regulation (WAC 173-340-360) are required to meet threshold and other requirements including protection of human health.¹³ However, the interim actions plans, which appear to have been developed to achieve final cleanup levels, do not address most of those requirements and seems to focus on cost as the rationale for selecting cleanup alternatives although no cost information is provided in the plan.

Recommendation: The work plan should be revised to address the threshold requirements including protection of human health and should provide supporting cost information since it appears to be a significant factor for selecting cleanup options.

12. **Section 4.1.4.2, Mobilization and Setup:** The work plan states that . . . during periods of rain, the trucks [that will be carrying excavated contaminated soils] will be covered to avoid generating contaminated runoff.”

Recommendation: Trucks transporting contaminated soils should be covered at all times to prevent human exposure to contaminants. The work plan should be revised accordingly.

13. **Section 5, Sampling and Analysis:** PAHs and BETX compounds are chemicals of concern for the three interim actions.

Recommendations: PAHs and BETX compounds should be analyzed as part of the characterization and confirmation sampling conducted during the interim actions. Table 5.1 should be revised accordingly.

14. **Section 5.2.2, Surface Soil Sampling:** The work plan indicates that surface samples will be collected from 0.1 to 2.0 feet below ground surface (bgs). However, this soil interval does not represent surface soil conditions typically encountered by people at a contaminated site such as the Rayonier facility.

Recommendation: DOH recommends that surface soil samples be collected from the upper 3 inches of the soil column.

Child Health Initiative

DOH recognizes that children can be uniquely vulnerable to the hazardous effects of environmental contaminants. When compared to adults, pound for pound of body weight, children drink more water, eat more food, and breathe more air. Children have a tendency to play closer to the ground and often put their fingers in their mouths. These facts lead to an increased exposure to contaminants in various environmental media. Additionally, the fetus is highly sensitive to many chemicals, particularly with respect to potential impacts on childhood development. For these reasons, it is very important to consider the specific impacts that

contaminants may have on children, as well as other sensitive populations.

Conclusions

1. Based on the information provided in the marine management plans and some the of reference documents, it appears that the data proposed to be collected during the marine RI for the Rayonier pulp mill will be inadequate for DOH to make a health determination.
2. Insufficient information is available for DOH to determine whether the proposed interim actions will result in removal of contaminated upland soils to levels that are protective of human health.

Recommendations/Action Plan

1. Rayonier, Inc. should revise the marine management plans and the interim actions plan based on the DOH recommendations provided in the Discussion section of this document.
2. Rayonier, Inc. should provide future plans and reports to DOH for review.

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Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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